EduMa

MATHEMATICS EDUCATION LEARNING AND TEACHING

article link: https://syekhnurjati.ac.id/jurnal/index.php/eduma/eduma/article/view/8064

Rearrangement of The Song Suwe Ora Jamu Using Fibonacci Numbers and Golden Ratio

Aliyatul Marzuqoh[1*], Toheri[2], Indah Nursuprianah[3]

1 Department of Mathematics Education, IAIN Syekh Nurjati Cirebon
2 Department of Mathematics Education, IAIN Syekh Nurjati Cirebon
3 Department of Mathematics Education, IAIN Syekh Nurjati Cirebon

*Corresponding author: Panguragan, Kabupaten Cirebon, Jawa Barat, Indonesia. e-mail addresses: aliyatulmarzuqoh@mail.syekhnurjati.ac.id ,

a r t i c l e   i n f o

a b s t r a c t

The rearrangement of the song suwe ora jamu uses the Fibonacci numbers and the golden ratio to facilitate the creation of music. The purpose of this study is to determine rearragement stages of the song suwe ora jamu using fibonacci numbers and golden ratio, to determine content of fibonacci numbers and golden ratio in the rearragement of the song suwe ora jamu, and to determine the difference in the beauty of the original song and rearrangement of the song suwe ora jamu uses fibonacci numbers and golden ratio. The method used in this research is mixed methods with a mixed-stage technique and a sequential exploratory strategy model. The results showed that: 1) 4 stages of rearrangement namely selecting the tone motif, determining the initial tone, determining the second tone using the initial tone or the previous tone as a reference, and determining the bar and its golden ratio, 2) analyzing the content of the Fibonacci numbers and the golden ration respectively are the song suwe ora jamu amounting to 32.1% and 61.804%, the first arrangement is 50% and 70.633% and the second arrangement are 46.2% and 98.887% and 3) the difference in the beauty of the original version of the song suwe ora jamu and the rear of the song suwe ora jamu using the Wilcoxon test is worth 0.000 <0.05, so it can be concluded that there is a difference in the beauty.

K e y w o r d s :

Rearrangement; Fibonacci Numbers; Golden Ratio; Suwe Ora Jamu

INTRODUCTION

The mathematics and music are two different things. Music usually deals with taste and soul while mathematics deals with numbers and logic. Music is entertainment whereas mathematics is complexity. Music is what mathematics reads. Mathematics is not only looking for numbers but can also look for equations or even look for patterns. The activity of looking for this pattern when associated with music is called harmony. Harmony is harmony; beauty. According to Lewin, mathematics provides a suitable framework for music theorists to tell the best way to listen to a piece of music (Suaefrizal, 2011). In this case, music and mathematics are closely related to one another. This is emphasized by Pramudhita (2019), if music consists of beats, rhythms, and tones then mathematics is a number.

When examined in the world of music, there are not a few music composers whose music works include the concept of the Fibonacci number and the golden ratio. One example is the song Just Give Me a Reason which was sung by a western musician PINK. In certain parts of this song there are elements of the Fibonacci sequence and the golden ratio that causes the song to sound popular and different from a song, be it a chorus, melody, or something else, this part is located in the 2.49 minute range of the song (Nasir, 2015).

In general, the Fibonacci numbers are the sequences that start from 0 and 1, then to find other numbers, add the two previous numbers. According to Rusli (2018) explaining that Fibonacci is a sequence of numbers with the next term in the sequence is the result of the sum of the two previous terms. In addition, the golden ratio of the Fibonacci sequence is called the golden ratio. The Golden ratio is a calculation that is used to produce perfect proportions and aesthetically attractive (Sihombing, 2015).

Researchers are interested in analyzing the content of the Fibonacci numbers and the golden ratio in the song suwe ora jamu which is a typical song from Central Java. Besides, the researchers also performed the composition of the song suwe ora jamu using the Fibonacci numbers and the golden ratio. The rearrangement results will be tested about differences in beauty. Researchers used the Wilcoxon test method to determine whether there was a difference in the beauty of the song Suwe ora Jamu and the rear composition of the song Suwe ora Jamu.

LITERATURE REVIEW

Fibonacci Number

Leonardo da Pisa (Fibonacci) calculated the population of pairs of rabbits in a particular month where this pair of rabbits gave birth to a pair of young rabbits. Then give birth again and so on, assuming that there are no dead rabbits. In the first and second months, there is one pair of rabbits, in the fourth month a pair of rabbits are born so that it becomes three pairs of rabbits, at the end of the fifth month two pairs of rabbits give birth to make five pairs of rabbits, and so on. The number of rabbits at the beginning of each consecutive month, namely 1, 2, 2, 3, 5, 8, 13, 21, ... this is what is called the Fibonacci sequence, and the terms are called the Fibonacci numbers (Irmawati, 2018).

The Fibonacci number is a sequence where the nth term is the sum of the term (n - 1) and the term (n - 2). In language, it can be said that the Fibonacci sequence is a

sequence of numbers with the next term in the line being the result of the sum of the two previous terms. For example, this sequence is given fo, f1, f2, ... with the conditions fo = 0 and f1 = 1 then the Fibonacci sequence is formulated to be fn = fn - 1 + fn - 2 for n = 2, 3, 4, ...(Rusli, 2018).

Golden Ratio

The Golden ratio or also called golden section is a calculation used to produce perfect proportions and aesthetically attractive. A golden ratio is an irrational number whose value is close to 1.6180. This figure often appears in the concepts of geometry, art, architecture, to human anatomical structures. The golden ratio is usually denoted by the letter phi (φ) (Sihombing, 2015).

The golden ratio is also often associated with the Fibonacci sequence, which is a sequence of numbers that is almost close to the golden ratio. In the series of comparisons, the greater the Fn value, the closer to the limit which is 1.6180 (Astinah, 2018).

We can calculate the golden ratio value through the form of the following formula:

$$\varphi = \frac{1+\sqrt{5}}{2} = 1{,}6180339887 \dots$$

And has the following conjugate values:

$$-\frac{1}{\varphi} = 1 - \varphi = \frac{1+\sqrt{5}}{2} = -0{,}6180339887 \dots$$

Aesthetic Value of Music

Music can be said to be beautiful if the elements that make up the art itself are fulfilled. The elements contained in the art of music are as follows (Jamalus, 1988):

a. The beauty of the melodic element, namely the arrangement of a series of tones (sounds with regular vibrations) that sound sequential and rhythmic and express thoughts and feelings.

b. The beauty of the elements of rhythm, which is the sequence of movements that make the song more beautiful to hear and feel.

c. The beauty of the element of harmony or chord, which is the sound of a combination of two or more tones with different high and low levels and sounds simultaneously.

d. The beauty of the structural elements, namely the ideas of the heart that are triggered and issued regularly and beautifully in the form of sound language that the listener can live with.

e. The beauty of the expressive element, which includes the dynamics and tempo in the art of music, is the loudness of the sound that is issued and the fast and slow the music is played.

METHODS

Population and Sample

According to Sugiyono (2016), The population is a generalization area consisting of objects and subjects that have certain qualities and characteristics that are determined

by the researcher to be studied and then draw conclusions. Based on the understanding of the population above, this research will be conducted on a population consisting of active students majoring in The department of mathematics education at IAIN Syekh Nurjati Cirebon.

Meanwhile, it is incomplete to speak the population without speaking the sample. According to Sugiyono (2016), the sample is part of the number of characteristics possessed by the population. That is, there are several important parts that must be considered, namely the similarity of characteristics to the population and selected using sampling techniques. The sampling technique used in this research is the purposive sampling technique. Purposive sampling technique is a sampling technique by deliberately making certain considerations. The sample used in this study was 27 students majoring in the department of mathematics education semester III / C, amounting to 27 students and V / A totaling 21 students because they have various favorite musical characters and are easy to contact.

Research Design

The research design is a strategy to obtain the data needed for hypothesis testing or to answer research questions and as a tool to control variables that affect research. As for this study using a type of combination research (mix method).

Combined research methods (mix methods) is a study that combines quantitative methods and qualitative methods to be combined together in a research activity so that comprehensive, valid, reliable, and objective data are obtained (Sugiyono, 2016). The combination research (mixed methods) is a combination of quantitative and qualitative research carried out simultaneously.

Combined research is needed to answer the problem formulation in this study. The first problem formulation can be answered through qualitative research and the second problem formulation can be answered through quantitative research. This research uses sequential mixed methods. According to Creswell (2015), This technique is a strategy in which the researcher combines the data found from one method with another. This strategy can be done by conducting interviews first to get qualitative data then followed by quantitative data.

The model used in this study is a sequential exploratory strategy. This strategy collects and analyzes qualitative data first and is followed by collecting and analyzing quantitative data based on the results of the qualitative data analysis stage. Broadly speaking, the research design can be shown in the following graph:
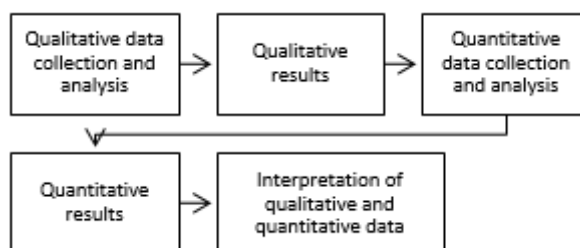

Figure 1
Research Design Graph

Based on Figure 1, the first stage in this research is to conduct literature studies and interviews and then analyze the qualitative data, namely knowing the composition of the song suwe ora jamu using the Fibonacci numbers and the golden ratio. Furthermore, in the second stage, the researchers conducted questionnaires and analyzed quantitative data to determine the difference in beauty in the song Suwe ora Jamu and the rear composition of the song Suwe ora Jamu using Fibonacci numbers and the golden ratio.

Data Processing Flow

Data analysis in this study used a gradual qualitative-quantitative data analysis. The analysis was carried out on qualitative data first and followed by quantitative data analysis. Qualitative data in the form of literature study and interviews were conducted with data reduction. Data reduction is the activity of summarizing or selecting the main and important things from the data needed according to the facts of the problem (Despalantri, 2015).

The next stage is processing quantitative data to determine answers to the main problems that have been formulated. The second problem formulation of this study is to test the beauty of the song Suwe ora Jamu that has been carried out by using the Fibonacci numbers. To process data from the questionnaire results that have been answered by the respondent, a Likert scale is used with the following scoring:

Table 1
Questionnaire Score

Positive Statement	Score	Negative Statement
Strongly Agree (SS) Agree (S) Disagree (S) Strongly Disagree (STS)	1 2 3 4	Strongly Disagree (STS) Disagree (S) Agree (S) Strongly Agree (SS)

Based on Table 1, the scoring for the questionnaire instrument is presented. The score will be used to determine the interpretation obtained from each aspect being measured. The data collected is processed by adding, compared to the expected amount and the percentage obtained or it can be written using the following formula (Arikunto, 2011).

$$Aesthetic\ Value\ (\%) = \frac{Observed\ score}{Expected\ score}\ x\ 100$$

The suitability of aspects in the beauty of the song Suwe ora Jamu after the rear analysis using the Fibonacci numbers can use a percentage scale table (Purwanto, 2013).

Table 2
Interpretation of Aesthetic Scale

Percentage (%)	Interpretation
81 – 100	Very Beautiful
61 – 80	Beautiful
41 – 60	Quite Beautiful
21 – 40	Not Beautiful
0 – 20	Not Very Beautiful

Based on Table 2, it can be seen the range of beauty presentations with their respective interpretations.

The data analysis technique to be carried out in this study is to use nonparametric statistical methods. This non-parametric statistical method is often called the free distribution method because the statistical test model does not specify certain conditions regarding the shape of the distribution of population parameters. The test used is the Wilcoxon test. According to Susetyo (2010), Wilcoxon test is a statistical method used to test the difference between two pairs of data, so the number of data samples is always the same. This is because, in addition to giving positive (+) and negative (-) signs to indicate differences in testing, a rating is also carried out on these differences.

The Wilcoxon test steps with the help of SPSS 25.0 software for windows operating systems are as follows:

a. Open the SPSS program then click the variable view to change the name according to the variables we are studying.

b. After naming click the data variable then fills in the data we get.

c. Click Analyze, next nonparametric test, select legacy dialogs, and then click 2 related samples.

d. In the city of test pairs, enter the data you want to compare the average and make sure there is a check in the Wilxocon box.

e. After clicking ok, the output "Wilcoxon Signed Ranks Test" will appear and look at the statistics box on asymp. Sig, (2-Tailed) to analyze it.

f. In the Wilcoxon test, there are two bases for decision making, namely if the Asymp value. Sig. (2-Tailed) is less than <0.05 then Ha is accepted and if the value is Asymp. Sig. (2-Tailed) is smaller than> 0.05, then Ha is rejected.

RESULT AND DISCUSSION

Rearrangement of The Song Suwe Ora Jamu Using Fibonacci Numbers and Golden Ratio Stages

Based on the results of the study, the stages in a rearrangement of the song suwe ora jamu using Fibonacci numbers and golden ratio through four stages are as follows:

a. Selection of tone motifs based on the value of taste and creativity of the author. The tone motives are as follows:

Table 3
Tone Motif

No	Tone Motif
1	3 4 5
2	i 5 3
3	4 5 3
4	i 3 5

Based on Table 3, it can be seen that the 3 digit tone motif will be used in the rear composition of the song suwe ora jamu.

b. Determine the initial note or tone of the song according to the voice character of the singer or you can also use the method of searching for a tone that has the same characteristics as the initial tone in the original Suwe ora Jamu song. In this study, the rear composition of the song suwe ora jamu used the initial tone i (do) (high).

c. Determines the second tone using the initial tone or the previous tone as a reference. The second tone used is the 5 tones for the first arrangement and the 3 tones for the second arrangement. Determine the third tone and so on also by looking at Table 3. Do this stage repeatedly to get a rearrangement on all lines of the song number notation suwe ora jamu. The results of the song suwe ora jamu on lines 1 - 4 that have been done at this stage are as follows:
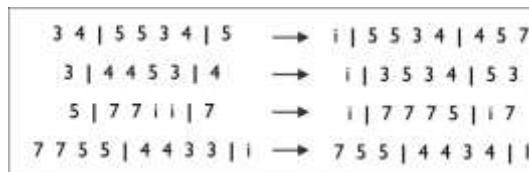

Figure 2
The First Rearrangement Process

Based on Figure 2, shows the change in the tone of the song suwe ora jamu before and after the first rear analysis using the Fibonacci numbers.
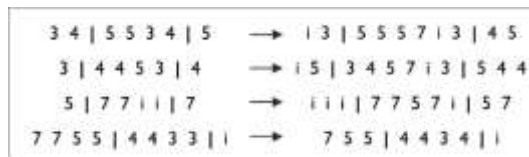

Figure 3
The Second Rearrangement Process

Based on Figure 2, shows the change in the tone of the song suwe ora jamu before and after the second rear analysis is done using the Fibonacci numbers.

d. The song rearrangement of suwe ora jamu has 8 bars and the balance of the song is located on the 5th bar which is located on the 3rd line of the song. The following is the rendition of the song suwe ora jamu using the Fibonacci numbers and the golden ratio:
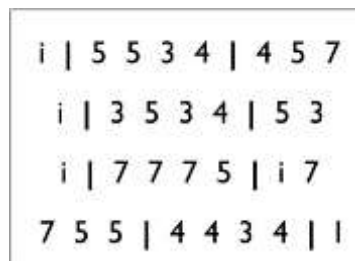

Figure 4
Results of The first Rearrangement

Based on Figure 4, shows the tone notation of the first rearance result or the tone notation of the song suwe ora jamu that has been performed using the Fibonacci number.

Figure 5
Results of The Second Rearrangement

In Figure 5, shows the tone notation of the first rearance result or the tone notation of the song suwe ora jamu that has been performed using the Fibonacci number.
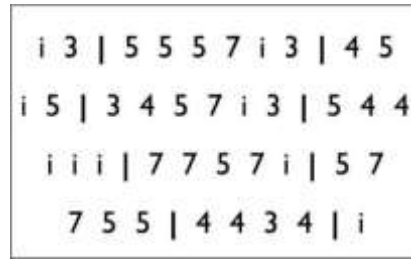
Content of Fibonacci Numbers and Golden Ratio

The content of the Fibonacci numbers and the golden ratio with solmization analysis and tone intervals and golden ratio analysis on the song suwe ora jamu and the rear composition of the song suwe ora jamu can be seen in the following table:

Table 4
Content of Fibonacci Numbers and Golden Ratio

Song	Fibonacci Number Content			Golden Ratio Content	
	Tone	Tones Sum	(%)	Value	(%)
Suwe Ora Jamu	9	28	32,1	1	61,804
First Arrangement	15	30	50	1,14286	70,633
Second Arrangement	18	39	46,2	1,6	98,887

Based on Table 4, it can be seen that the content of the Fibonacci number and the golden ratio of each song is the song suwe ora jamu which contains the Fibonacci number 9 tones from 28 total tones of 32.1% and the golden ratio value is 1 with the content of 61.804%, The first rearrangement of song suwe ora jamu contains a Fibonacci number of 15 tones from 30 total tones of 50% and a golden ratio value of 1.14286 with the content of 70.633% and the second arrangement of song suwe ora jamu contains a Fibonacci number of 18 tones from 39 total tones of 46.2 % and the golden ratio value is 1.6 with the content of 98.887%.

The difference in the beauty of rearrangement of the Song Suwe Ora Jamu

To find out the difference in the beauty of the song suwe ora jamu and the rear composition of the song suwe ora jamu using the Fibonacci numbers and the golden ratio, the authors have collected data through literature studies, interviews, and questionnaires.

The results of the interviews with the speakers explained that the song suwe ora jamu and the rear composition of the song suwe ora jamu have several differences related to their musical elements. In the melodic element, the song suwe ora jamu and the second arrangement have a clear and strong melody, while in the first arrangement the melody is a little fuzzy. In addition, the harmony and rhythm in the song Suwe ora Jamu and the second arrangement are quite beautiful and comfortable to hear while the first arrangement is a bit messy. The tempo and tone color of the original version of the song suwe ora jamu is a little slow and quiet so it sounds boring, while the first arrangement

and the second arrangement have medium tempo and various tonal colors. The dynamics of the song Suwe ora Jamu and the second arrangement can be felt compared to the first arrangement.

Table 5
Result of Interview

Element	Suwe Ora Jamu	Arrangement 1	Arrangement 2
Melody	Clear and Strong	Escape	Clear and Strong
Rhythm	Beautiful	Less Beautiful	Beautiful
Harmony	Neat	What a mess	Neat
Tempo	Slow	Moderate	Moderate
Dynamic	Strong	There is no	Enough
Color Tone	Quiet	Variety	Variety
Structure	Correct	Correct	Correct

Based on Table 5, shows an outline of the results of interviews with music expert sources.

To determine the level of beauty of the song Suwe ora Jamu song rear analysis, the researcher used a Likert scale questionnaire as a data collection instrument. The questionnaire was then distributed to 48 respondents with 30 questions consisting of 5 aspects, namely melody, rhythm, harmony, structure, and expression. The results of the distribution of the questionnaire showed that the score data for the beauty level of the song Suwe ora Jamu, the first rendition song, and the second arrangement song were as follows:

Table 6
Percentage of Questionnaire Score

Song	Expect Score	Obser Score	(%)
Suwe Ora Jamu	5760	5059	87,83
Arrangement 1	5760	5136	89,17
Arrangement 2	5760	5415	94,01

Based on Table 6, it is known that the percentage of the beauty of each song is the song suwe ora jamu which is 87.83%, the first rear composition of the song suwe ora jamu is 89.17%, and the second rear composition of the song suwe ora jamu is 94.01%. Based on the beauty category in Table 2, the song suwe ora jamu, the first and second arrangement of the song suwe ora jamu uses the Fibonacci numbers and the golden ratio in the criteria for beauty is "Very Beautiful".

At this stage, the data needed to analyze the differences in the beauty of the song Suwe ora Jamu and the rear composition of the song Suwe ora Jamu are the results of the wilcoxon test from the questionnaire scores of each respondent. The results are as follows:

Table 7
Wilcoxon Ranks Test Output Results

		N	Mean Rank	Sum of Ranks
	Ranks			
Arrang ement 1 - Suwe Ora Jamu	Negative	0[a]	0.00	0.00
	Positive	36[b]	18.50	666.00
	Ties	12[c]		
	Total	48		
Arrang ement 2 - Suwe Ora Jamu	Negative	0[d]	0.00	0.00
	Positive	47[e]	24.00	1128.00
	Ties	1[f]		
	Total	48		

Based on Table 7, the Negative Ranks line shows the negative difference between the beauty value for the song suwe ora jamu and the music behind the song suwe ora jamu. That is, in this study, the negative difference between the value of N, the mean rank, and the sum of ranks is 0. The value of 0 in this study shows that there is no decrease (reduction) in the beauty value of the song Suwe ora Jamu with arrangement 1 and the song Suwe ora Jamu. with arrangement 2.

The positive ranks line shows the positive difference between the beauty value for the song Suwe ora Jamu and the music behind the song Suwe ora Jamu. In this study, there are 36 positive data (N), which means that 36 respondents experienced an increase in the beauty rating of the song Suwe ora Jamu to the 1st arrangement and 47 positive data (N) which means that the 47 respondents experienced an increase in the beauty assessment of the song Suwe ora Jamu to the arrangement. 2. The mean rank or the average increase is 18.50 for an increase in the beauty rating of the song Suwe ora Jamu to the 1st arrangement and 24.00 for the increase in the beauty rating of the song Suwe ora Jamu to the 2nd arrangement. The Positive ranking is 666.00 for an increase in the beauty rating of the song Suwe ora Jamu to arrangement 1 and 1128.00 for an increase in the assessment of the beauty of the song Suwe ora Jamu to arrangement 2.

The ties line shows the similarity of the beauty value of each respondent in the song suwe ora jamu and the rear composition of the song suwe ora jamu. There is a tied value of 12 for the assessment of the beauty of the song Suwe ora Jamu to the 1st arrangement and 1 for the beauty assessment of the song Suwe ora Jamu to the 2nd arrangement. It can be said that there are 12 respondents who have the same value for the beauty assessment of the song Suwe ora Jamu to the arrangement. 1 and 1 respondents have the same value for the beauty assessment of the song Suwe ora Jamu to arrangement 2.

Based on the results of the research with the Wilcoxon test, it can be seen that the difference in the beauty of the song Suwe ora Jamu and the rear composition of the song Suwe ora Jamu with the following hypothesis criteria:

a. If the value is Asymp. Sig. (2-tailed) is less than <0.05, then Ha is accepted.

b. Conversely, if the value of Asymp. Sig. (2-tailed) is greater than> 0.05, then Ha is rejected.

Table 8
Results of the Wilcoxon Test Statistic Output

Test Statistcs	Arrangement 1 - Suwe Ora Jamu	Arrangeme nt 2 - Suwe Ora Jamu
Z	-5.303[b]	-5.978[b]
Asymp. Sig. (2-tailed)	0.000	0.000
a. Wilcoxon Signed Ranks Test		
b. Based on negative ranks		

Based on Table 8, it is known that Asymp. Sig. Arrangement 1 - Suwe Ora Jamu and Asymp. Sig. Arrangement 2 - Suwe Ora Jamu is worth 0.000, which means it is less than <0.05, so based on the hypothesis in this study, H_a is accepted. From this analysis, it can be concluded that there are differences in the beauty of the song Suwe ora Jamu and the rearrangement of the song Suwe ora Jamu using the Fibonacci numbers and the golden ratio.

CONCLUSION

Based on the results of research on the composition of the song Suwe ora Jamu using the Fibonacci numbers and the golden ratio, it can be concluded as follows:

a. The stage of the song suwe ora jamu using the Fibonacci number and the golden ratio, there are 4 stages, namely selecting the tone motif, determining the initial tone, determining the second tone using the initial tone or the previous tone as a reference, and determining the bar and the golden ratio value.

b. The original version of the song suwe ora jamu contains the Fibonacci number of 32.1% and the accuracy of the golden ratio of 61.804%, the first arrangement of the song suwe ora jamu contains 50% of the Fibonacci number and the accuracy of the golden ratio of 70.633% and the second arrangement of the song suwe ora jamu contains a Fibonacci number of 46.2% and the accuracy of the golden ratio of 98.887%.

c. The Percentage of the beauty of each song is the song suwe ora jamu at 87.83%, the first arrangement of the song suwe ora jamu by 89.17%, and the second arrangement of the song suwe ora jamu for 94.01%. Based on the category of beauty, the song suwe ora jamu, the first and second rearrangement of the song suwe ora jamu in the criteria of beauty is "Very Beautiful". The difference in the beauty of the original version of the song Suwe ora Jamu and the rearrangement of the song Suwe ora Jamu using the Wilcoxon test is Asymp. Sig. Arrangement 1 - Suwe Ora Jamu and Asymp. Sig. Arrangement 2 - Suwe Ora Jamu is worth 0.000 <0.05, so it can be concluded that there is a difference in the beauty of the song Suwe ora Jamu and the rearrangement of the song Suwe ora Jamu using the Fibonacci numbers and the golden ratio.

REFERENCES

Arikunto, S. (2011). *Dasar-dasar Evaluasi Pendidikan (Edisi Revisi)*. Jakarta: Bumi Aksara.

Astinah, M. D. (2018). *Improvisasi Lagu Lingsir Wengi Versi Sunan Kalijaga Menggunakan Barisan Fibonacci dan Golden Ratio*. Surabaya: Sripsi. UIN Sunan Ampel Surabaya.

Creswell, J. (2015). *Riset Pendidikan*. Yogyakarta: Pustaka Belajar.

Despalantri, E. (2015). *Pelaksanaan Pendidikan Inklusif Di SMP Negeri Kota Payakumbuh Berdasarkan Indeks Inklusif*. Bandung: Skripsi. Universitas Pendidikan Indonesia.

Irmawati, & dkk. (2018). *Penggunaan Matematika, Statistika, dan Komputer dalam Berbagai disiplin Ilmu untuk meningkatkan Daya Saing Bangsa dalam Bidang Sains dan Teknologi*. Prosding Seminar Nasional Metode Kuantitatif II 2018, 49-52.

Jamalus. (1988). *Pengajaran musik melalui pengalaman musik*. Jakarta: Departemen Pendidikan dan Kebudayaan.

Nasir, R. (2015, Maret 30). *Fibonacci Numbers and Phi in Music. Diambil kembali dari Geometry* Retrived from https://geometryarchitecture.wordpress.com/

Pramudhita, C. R. (2019). *Hubungan Kebiasaan Mendengarkan Musik, Pemanfaatannya saat Belajar Matematika Terhadap Hasil Belajar Mata Pelajaran Matematika Siswa Kelas XI Di Smk Pika Semarang* (Doctoral dissertation, UNNES). Retrived from http://lib.unnes.ac.id/34927/

Purwanto. (2013). *EvalVasi Hasil Belajar*. Yogyakarta: Pustaka Belajar.

Rusli, M., & dkk. (2018). *Logika & Matematika*. Yogyakarta: CV. Andi Offset.

Sihombing, D. (2015). *Tipografi dalam Desain Grafis*. Jakarta: PT Gramedia Pustaka Utama.

Suaefrizal. (2011). *Aplikasi Matematika Pada Transposisi Tangga Nada Musik*. Medan: Skripsi. Universitas Sumatera Utara.

Sugiyono. (2016). *Metode Penelitian Pendidikan Pendekatan Kuantitatif, Kualitatif dan R&D*. Bandung: Alfabeta.

Susetyo, B. (2010). *Statistika Untuk Analisis Data Penelitian*. Bandung: Refika Aditama.